Alternate Proof of: LR $\sim \chi^2$

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In class we went over the fact that the log-likelihood ratio (LR) is asymptotically χ^2 distributed. I think you mentioned a complicated proof by Wilks (1938) [1] that originally showed it. I just wanted to mention another proof of it that maybe isn't totally airtight but I thought was interesting.

This property of the LR came up when we were talking about MLE (I think) and you were comparing the likelihood of the unconstrained model, $\mathcal{L}$

References

[1] Wilks, Samuel S. The large-sample distribution of the likelihood ratio for testing composite hypotheses. The Annals of Mathematical Statistics 9.1 (1938): 60-62.